CONGRESSIONAL HEARING PRESENTATION
June 15, 2005

Widespread Anabolic Steroid Use in American Girls and Women: An Illusion?

Harrison G. Pope, Jr., M.D., M.P.H.
Professor of Psychiatry, Harvard Medical School

At present, in my opinion, there is no methodologically sound scientific evidence that there exists a widespread public health problem of anabolic steroid use among teenage girls or young women in the United States. Although some recent surveys have reported high rates of anabolic steroid use among teenage women, I believe that these figures are likely erroneous, and are caused largely by so-called "false positive" responses on the anonymous questionnaires used in the surveys. A "false-positive" response is a case where a student has *erroneously answered* "yes" to a question about anabolic steroid use, even though in fact he or she has not used actual anabolic steroids at all (see slide 1).

One example of such an anonymous questionnaire is that used by the Youth Risk Behavior Surveillance System of the Centers for Disease Control (CDC). In a recent Surveillance Summary,[1] this study reported that 7.3% of ninth-grade girls reported "lifetime illegal steroid use" (see slide 2).

But how many of these 7.3% had used actual *anabolic steroids* – the type of "steroids" that are used for their muscle-building properties, that are illegal drugs of abuse controlled by the Drug Enforcement Administration, and that are the subject of this Congressional testimony? Anabolic steroids (or, more technically, "anabolic-androgenic steroids") are a family of hormones that includes testosterone (which is nature's own anabolic steroid, so to speak) and a group of other chemicals that are synthetic relatives of testosterone, such as Deca-Durabolin (nandrolone), Winstrol (stanozolol), Anadrol (oxymetholone), Equipoise (boldenone) and others (see slide 3).[2] There is no question that anabolic steroid use by *men* represents an important public health problem in the United States. But how many American girls or women have used actual anabolic steroids like those just listed?

To answer this question, we must understand that the CDC survey, like most other surveys of illicit drug use in students, was based on *anonymous questionnaires.* Therefore, it was not possible to identify the specific girls who answered "yes" about "steroid use," and then go back and interview them to confirm that they really had used actual anabolic steroids. In other words, we have *no method to eliminate possible "false-positive" responses* (see slide 4).

Let us consider the actual wording of the questions used in anonymous surveys of students. The CDC questionnaire,[3] for example, asks, "During your life, how many times have you taken **steroid pills or shots** without a doctor's prescription?" Note that the question does not specify what a "steroid" is; it does not explain that we are interested specifically in *anabolic steroids* – the illegal drugs of abuse that are the subject of this testimony (see slide 5).

Upon reading this question, many students might erroneously answer "yes," because they may

think that they have taken “steroids,” even though in reality they have not taken actual *anabolic steroids* at all. For example, they might answer “yes” because they have used steroid skin creams, such as those used for poison ivy. These skin preparations, some of which are available over the counter, contain *corticosteroids*, rather than anabolic steroids. Chemically speaking, corticosteroids are a type of steroid molecule, but they have no muscle-building effects, are not drugs of abuse, and are virtually never sold on the black market. A student might also answer “yes” because she had used steroid-containing asthma inhalers – but again these inhalers contain corticosteroids, not the anabolic steroids that are drugs of abuse. Birth control pills also contain substances that are chemically types of steroids – substances like estrogen and progesterone. But again, these steroids have essentially no abuse potential, no muscle-building effects, and no availability on the black market. Then, there are *adrenal steroids* like "andro" (androstenedione) or dehydroepiandrosterone (DHEA). Andro and its chemical relatives have some weak muscle-building properties, and until last year could be purchased legally over the counter in sports-supplement and health food stores. But andro and its relatives are *also* not true anabolic steroids; they are adrenal steroids that are only weakly metabolized into small amounts of anabolic steroids in the body. Therefore, they are not comparable to the genuine illegal anabolic steroids that are the subject of this testimony here. In short, if a high school girl has used corticosteroids, or birth-control steroids, or adrenal steroids, she may answer "yes" to a question asking if she has taken "steroid pills or shots," but this will be a *false positive response*, because she has not in fact taken real anabolic steroids at all (see slide 6).

Additional false positives may arise if students confuse other types of substances with anabolic steroids. For example, many substances sold in sports supplement stores are claimed to help build muscles. Examples are creatine, protein powders, amino acids, or pills with names that may sound like genuine anabolic steroids, such as "Sterol." Once again, students who have used these substances may *think* that they have taken “steroids,” and hence give a false-positive answer of “yes” on the questionnaire, although in fact they have not taken actual anabolic steroids at all (see slide 7).

Going back to the CDC survey question, we find other problems that might further increase the risk of “false-positives.” Note that the question asks, "How many times have you taken steroid pills or shots *without a doctor's prescription*?" (Italics added here for emphasis). But actual anabolic steroids are rarely prescribed by ordinary doctors; only certain specialists regularly prescribe anabolic steroids, and then only for certain restricted situations – such as for so-called “hypogonadal” men who do not manufacture enough testosterone in their own bodies. Therefore, by including the phrase "without a doctor's prescription," the question may further mislead a high school girl, because she may assume that “steroids” are drugs that doctors commonly prescribe – which they don't.

Also note that the question asks "how many times" the individual has taken "steroid pills or shots." But actual anabolic steroids are not taken at individual “times” in the matter of other drugs of abuse; instead they are taken for an entire block of time – say, 8 to 16 weeks – as a *course* of drugs taken every day (referred to by illicit anabolic steroid users as a "cycle"). Therefore, by phrasing the question in terms of "how many times…." the student might be misled even further – thinking that the question was asking about some type of drug that is taken in a single dose on individual occasions, rather than for a block of time. Looking at these various

factors, then, we see that they may all combine together to increase the rate of “false positives” – thus possibly creating a greatly exaggerated estimate of the true rate of anabolic steroid use among students.

In summary, then, we cannot simply add up all of the "yes" answers from a question about "steroids" on an anonymous questionnaire and then conclude that these cases all represent individuals who have actually used genuine anabolic steroids. If we did, it would be analogous to circulating a questionnaire in which we asked students, "Have you ever broken the law? – and then concluding that everybody who answered "yes" had committed a felony.

Let me emphasize that *I do not mean to be specifically critical of the CDC questionnaire here*. Other anonymous questionnaires suffer from many of the same problems of ambiguity. If an anonymous questionnaire does not go into great detail to specifically distinguish anabolic steroids from all the other substances that might be mistakenly labeled as “steroids” by respondents, the possibility for false positives is inevitably present. How would one avoid such false positives? The most direct approach, clearly, would be to do a survey using confidential interviews, in which a trained interviewer asked the respondent in person about use of anabolic steroids. Then, if the individual answered "yes," the interviewer could immediately follow up and confirm that the individual had indeed used genuine anabolic steroids (see slide 8).

In fact, just such a large face-to-face confidential interview study has been done: every year, the federal government conducts a large interview study of drug use in a scientific random sample of Americans. This survey, currently called the "National Survey on Drug Use and Health" was formerly called the "National Household Survey" (see slide 9).

The most recent year, to my knowledge, in which the National Household Survey assessed anabolic steroid use was in 1994. In the course of the 1994 survey, the interviewers conducted confidential interviews of 7,514 women between the ages of 15 and 44.[4] Of these 7,514 women, *only 18 women, or 0.2%*, reported that they had ever used anabolic steroids at any time in their lives. In other words, when we largely eliminate the problem of false positives by using face-to-face interviews, a 7.3% figure drops to only 0.2% (see slide 10).

Now it might be argued that the 0.2% figure from the National Household Survey dates from 1994, whereas the CDC figure of 7.3% dates from 2003. Perhaps, it might be argued, rates of anabolic steroid use have soared upward in that nine-year interval. However, this argument does not appear to be correct. If we look, for example, at the Monitoring the Future Study (MTF Study), which also includes a question about steroid use every year, we find that the overall rates of steroid use on this survey have not changed greatly over the last 10 years. For example, the percentage of eighth-graders of *both sexes* who claimed to have used steroids on the MTF Study was 2.0% in 1994 and 1.9% in 2004. For 12th graders, figures for both sexes combined were 2.4% in 1994 and 3.4% in 2004. [5] These figures suggest that there has not been any dramatic uptrend in steroid use over the last 10 years, and that therefore the personal interview data obtained by the National Household Survey in 1994 would not be enormously different if it were obtained today in 2005 (see slide 11).

Parenthetically, the rates for steroid use among *girls* in the 2004 MTF Study were 1.0% of

eighth-graders and 0.9% of tenth-graders[5, p. 38] – in striking contrast to the CDC figure of 7.3% of ninth-graders in 2003 – despite the fact that both studies were large anonymous questionnaire studies of national samples of high-school students. Why the much lower rates in the MTF Study? Very likely the difference is because the MTF Study used a more precise question: "Steroids, or anabolic steroids, are sometimes prescribed by doctors to promote healing from certain types of injuries. Some athletes, and others, have used them to try to increase muscle development. On how many occasions (if any) have you taken steroids on your own—that is, without a doctor telling you to take them?"

This question explains more clearly what a "steroid" is, and thus will produce fewer false positives – which likely explains why MTF found only about a 1% rate in girls, rather than 7%. But even the 1% rate is still probably a substantial overestimate, because even the MTF question will still produce some false positives. Like the CDC question, the MTF question incorrectly seems to imply that anabolic steroids are commonly prescribed (something that your local doctor might "tell you to take"), and the MTF question also implies that anabolic steroids are taken on individual "occasions," rather than as a "cycle," as explained above. Finally, despite the more precise wording of the question, a few high-school students are still going to mistakenly think that they have taken anabolic steroids when in fact they have taken one of the other substances listed above (slides 6 and 7). Even if such mistakes are quite rare, and only one girl in 100 erroneously answers "yes" when she should say "no," we would have a 1.0% *apparent* rate of anabolic steroid use from false-positives alone. Therefore, it is plausible that the 1.0% and 0.9% rates in the 2004 MTF study, quoted above, are composed almost entirely of false-positives; the 0.2% rate found in face-to-face interviews in the National Household Study remains the most reliable measure.

One other possible criticism of the National Household Survey is that it might have underestimated rates of anabolic steroid use, because some individuals might not have disclosed their use of anabolic steroids to the interviewer, despite the assurances that the interviews were confidential. However, this argument also does not appear to be correct, because rates of other drugs of abuse obtained in the National Household Survey are very close to the rates obtained in school surveys for drugs for which there is very little problem of false positives, such as marijuana.[4,5] Therefore, there is no good evidence that the National Household Survey seriously underestimated rates of anabolic steroid use because of non-disclosure (see slide 12).

Looking at peer-reviewed scientific studies of anabolic steroid users published in the last five years, I can find only one in which investigators actually located women who had used anabolic steroids and interviewed them in person – and this was a study that I authored in the year 2000.[6] In this study, we received a grant from the National Institutes on Drug Abuse to study anabolic steroid use by women; we aggressively attempted to recruit study subjects throughout Eastern Massachusetts – a region with millions of individuals – going to the most "hard-core" gyms that we could find, where female steroid users might be expected to be found in the greatest numbers. After two years of effort, we were able to recruit only 17 women in the entire Boston metropolitan area who had used anabolic steroids. In preparation for this testimony, I went back and reviewed our data from that study; I found that *none* of the 17 women had begun to use anabolic steroids prior to age 18. In other words, in the entire metropolitan Boston area, with aggressive recruiting efforts, we did not find a single woman who had used actual anabolic

steroids in high school.

Similarly, in another study from my laboratory published in 2001, we gave questionnaires to 511 men and women walking in the door at five different gymnasiums in the greater Boston area.[7] We had no problem finding men who had used anabolic steroids; out of 334 men who took a questionnaire, there were 18, or about 5%, who reported that they had used anabolic steroids at some time in their lives. However, out of 177 women who received questionnaires at the same gyms, there were *none* who reported that they had ever used anabolic steroids. Now, if the rate of anabolic steroid use among high school girls in general were truly 7%, one would expect the rate among women in gyms to be much higher than 7%, because women going to gyms to work out would be more likely to have used anabolic steroids than women in general. Therefore, it is particularly telling that we found no cases of anabolic steroid use in this population.

In short, both of these two studies from my laboratory appear consistent with the 0.2% rate of anabolic steroid use among women found in the National Household Survey, and inconsistent with the much higher rates derived from anonymous survey data.

Now of course one might argue that perhaps there has been a sudden surge of anabolic steroid use among high school girls just in the few years since we conducted the above two studies, or that anabolic steroid use by women is concentrated in parts of the United States other than Boston. But once again, as mentioned earlier, the annual survey data from the MTF Study, which spans the entire country, shows no such surge over the last several years. And even if we were to grant that there has been some increase in the last five years, it certainly could not create a change from practically 0% to 7%.

In summary, we cannot responsibly conclude that there is currently a widespread public health problem of illegal anabolic steroid use among teenage girls – unless we see new, *valid* data to the contrary. Such data would have to be obtained in a methodologically sound fashion, designed to prevent “false positives.” We also cannot responsibly draw conclusions from testimonials by a few teenage girls who say that they have taken genuine anabolic steroids, or anecdotal accounts by individuals who know a few girls who have taken these drugs. Mere testimonials *are not scientific evidence,* and should not be used as a basis for policy decisions (see slide 13).

In conclusion, how could we get new, valid data on the rates of anabolic steroid use among high school girls? Two methods come immediately to mind. The first is simple: the next time that we do an anonymous survey, we can simply ask respondents who answer "yes" to *write in the name of the steroid or steroids that they have taken*. If a girl writes in that she has taken, say, testosterone injections or Anadrol pills, then she would count as a genuine case of illegal anabolic steroid use. But if she writes in that she used steroids for poison ivy, or her sister's steroid asthma inhaler, or steroid pills for birth control, or names any substance that she has purchased legally over the counter in a health food or sports-supplement store, then she would be eliminated as a "false positive" (see slide 14).

A second, equally simple strategy would be to put anabolic steroids back into the annual National Survey on Drug Use and Health, the direct face-to-face interview survey that I have described above (see slide 15). As mentioned, anabolic steroids have not been covered in this

interview survey, to my knowledge, since 1994 (at which time it was called the "National Household Survey"). If we were to include anabolic steroids in the National Survey on Drug Use and Health in 2006 and subsequent years, we could easily estimate the percentage of women under the age of 18 who had used anabolic steroids at some time in their lives. These data could be compared with the last round of anabolic steroid data from the 1994 version of the National Household Survey, quoted above.

I would be willing to predict, here in this congressional testimony, that if we used either 1) anonymous questionnaires, distributed to a large, nationally representative sample of current American high school students, using a "write-in" method to rule out false positives – as just described above, or 2) direct face-to-face interviews in the National Survey on Drug Use and Health, we would find that less than 1% – and indeed probably only a few tenths of a percent – of teenage girls have used actual anabolic steroids. I would be eager to see my prediction put to the test, and would be happy to concede that I am wrong if my predictions are not confirmed. **Until such a test is done, however, I would strongly question the assertion that there is currently a widespread public health problem of anabolic steroid use by teenage girls or young women in the United States.**

References

1. Source: Center for Disease Control and Prevention Surveillance Summaries, May 21, 2004, MMWR 2004: 53(No SS-2)

2. Pope HG Jr, Brower KJ. Anabolic-Androgenic Steroid Abuse. In: Sadock BJ, Sadock VA, eds. Comprehensive Textbook of Psychiatry/VIII. Philadelphia PA: Lippincott Williams & Wilkins, 2005. Pp1318-28.

3. Center for Disease Control and Prevention 2005 Youth Risk Behavior Survey. http://www.cdc.gov/HealthyYouth/yrbs/pdfs/2005highschoolquestionnaire.pdf

4. Substance Abuse and Mental Health Data Archive (SAMHDA) National Household Survey on Drug Abuse, 1994. http://webapp.icpsr.umich.edu/cocoon/SAMHDA-SERIES/00064.xml

5. Source: National Institute on Drug Abuse. Monitoring the Future national results on adolescent drug use: Overview of key findings, 2004. http://monitoringthefuture.org/pubs/monographs/overview2004.pdf

6. Gruber AJ, Pope HG Jr. Psychiatric and medical effects of anabolic-androgenic steroid use in women. Psychother Psychosom 2000;69:19-26.

7. Kanayama G, Gruber AJ, Pope HG Jr, Borowiecki JJ, Hudson JI. Over-the-counter drug use in gymnasiums: an underrecognized substance abuse problem? Psychother Psychosom 2001;70:137-40.

There is **no methodologically reliable scientific evidence** that there is a serious problem of anabolic steroid use by teenage women in the United States.

Anabolic steroid use by teenage women is probably greatly exaggerated by **“false positive”** questionnaire responses. 1

Vol. 53 / SS-2 Surveillance Summaries 61

TABLE 32. Percentage of high school students who inhaled intoxicating substances and who took steroids, by sex, race/ethnicity, and grade — United States, Youth Risk Behavior Survey, 2003

	Lifetime inhalant use*						Current inhalant use†						Lifetime illegal steroid use§					
	Female		Male		Total		Female		Male		Total		Female		Male		Total	
Category	%	CI¶ (±)	%	CI (±)	%	CI (±)	%	CI (±)	%	CI (±)	%	CI (±)	%	CI (±)	%	CI (±)	%	CI (±)
Race/Ethnicity																		
White**	12.2	2.0	13.3	1.6	**12.8**	**1.5**	3.2	1.1	4.0	0.7	**3.6**	**0.7**	5.6	2.1	6.8	1.6	**6.2**	**1.8**
Black**	6.4	1.9	7.5	2.1	**7.0**	**1.4**	2.2	0.9	3.8	1.9	**3.0**	**1.0**	1.9	1.3	5.4	2.2	**3.6**	**1.6**
Hispanic	13.9	2.3	11.6	2.3	**12.7**	**2.1**	4.7	1.8	3.9	1.6	**4.3**	**1.3**	6.6	2.1	7.8	3.2	**7.2**	**2.5**
Grade																		
9	14.6	2.8	12.7	1.9	**13.6**	**2.0**	5.7	1.6	5.0	1.5	**5.4**	**1.3**	7.3	2.6	6.9	3.0	**7.1**	**2.6**
10	10.3	1.6	11.9	1.4	**11.1**	**1.1**	2.6	1.0	4.3	1.3	**3.5**	**0.9**	5.1	2.3	7.0	2.3	**6.1**	**1.8**
11	9.4	2.0	12.6	2.9	**11.0**	**2.1**	2.0	0.8	4.1	1.5	**3.1**	**0.9**	4.3	1.7	6.8	2.5	**5.6**	**1.8**
12	10.3	2.2	13.1	2.9	**11.8**	**2.2**	2.3	1.0	3.1	1.2	**2.7**	**1.0**	3.3	1.5	6.4	2.3	**4.9**	**1.7**
													5.3	**1.6**	**6.8**	**1.7**	**6.1**	**1.5**

r lifetime.
30 days preceding the survey.

	Lifetime illegal steroid use§					
	Female		Male		Total	
Category	%	CI (±)	%	CI (±)	%	CI (±)
Race/Ethnicity						
White**	5.6	2.1	6.8	1.6	**6.2**	**1.8**
Black**	1.9	1.3	5.4	2.2	**3.6**	**1.6**
Hispanic	6.6	2.1	7.8	3.2	**7.2**	**2.5**
Grade						
9	7.3	2.6	6.9	3.0	**7.1**	**2.6**
10	5.1	2.3	7.0	2.3	**6.1**	**1.8**
11	4.3	1.7	6.8	2.5	**5.6**	**1.8**
12	3.3	1.5	6.4	2.3	**4.9**	**1.7**
Total	**5.3**	**1.6**	**6.8**	**1.7**	**6.1**	**1.5**

Source: Center for Disease Control and Prevention. 2
Surveillance Summaries, May 21, 2004, MMWR 2004: 53(No SS-2).

Actual Illegal Anabolic Steroids

- Testosterone
- Deca-Durabolin
- Anadrol
- Winstrol
- Equipoise

3

Problems with Recent Anonymous Surveys:

- Students were never interviewed personally
- There was no way to go back and confirm that a “yes” answer was actually a legitimate “yes.”

4

During your life, how many times have you taken **steroid pills or shots** without a doctor's prescription?

- (A) 0 times
- (B) 1 or 2 times
- (C) 3 to 9 times
- (D) 10 to 19 times
- (E) 20 to 39 times
- (F) 40 or more times

Source: Center for Disease Control and Prevention
2005 Youth Risk Behavior Survey
http://www.cdc.gov/HealthyYouth/yrbs/pdfs/2005highschoolquestionnaire.pdf

5

These are Not Anabolic Steroids

- **Corticosteroids**
  - Steroid skin creams for poison ivy
  - Steroid inhalers for asthma
- **Sex Steroids**
  - Birth control pills
- **Adrenal Steroids**
  - "Andro" (Androstenedione)
  - DHEA (Dehydroepiandrosterone)

6

These are Not Anabolic Steroids

- **Supplements**
  - Creatine
  - "Sterol"
  - "Secretagogue-One"
  - "Tribulus Terrestris"
  - "T-Bomb II"
  - "Xenadrine"

7

False positives can be eliminated by interviewing participants directly.

8

National Household Survey

Assesses the prevalence of drug use in the United States, based on confidential direct personal interviews of a scientific random sample of American households

9

National Household Survey, 1994:

Anabolic Steroid Use Among 7514 Women Age 15-44:

Never Used Anabolic Steroids	**7496**	**99.8%**
Ever Used Anabolic Steroids	**18**	**0.2%**

Source: Substance Abuse and Mental Health Data Archive (SAMHDA)
National Household Survey on Drug Abuse, 1994
http://www.icpsr.umich.edu/cgi-bin/SDA/hsda?samhda+nhsda94b

10

Monitoring the Future Study

Rates of "Steroid" Use (Both Sexes Combined)

	1994	2004
8th Grade	**2.0 %**	**1.9%**
10th Grade	**1.8%**	**2.4%**
12th Grade	**2.4%**	**3.4%**

Source: National Institute on Drug Abuse
Monitoring the Future national results on adolescent drug use: Overview of key findings, 2004.
http://monitoringthefuture.org/pubs/monographs/overview2004.pdf

11

Ever used Marijuana, 1994 (by 12th grade)

Monitoring the Future Study	**38.2%**
National Household Survey	**32.7%**

Sources:
National Institute on Drug Abuse
Monitoring the Future national results on adolescent drug use: Overview of key findings, 2004.
http://monitoringthefuture.org/pubs/monographs/overview2004.pdf

Substance Abuse and Mental Health Data Archive (SAMHDA)
National Household Survey on Drug Abuse, 1994
http://www.icpsr.umich.edu/cgi-bin/SDA/hsda?samhda+nhsda94b

12

Do not be misled by personal testimonials or by anecdotal accounts involving a few teenage girls

THIS IS NOT SCIENCE!

13

How Could we Get Valid Data? Option 1

During your life, how many times have you taken **steroid pills or shots** without a doctor's prescription?

(A) 0 times
(B) 1 or 2 times
(C) 3 to 9 times
(D) 10 to 19 times
(E) 20 to 39 times
(F) 40 or more times

If you have used steroids one or more times, please write down the names of the steroids that you used: _____

_____

_____

14

How Could we Get Valid Data? Option 2

Reintroduce anabolic steroids into the National Survey on Drug Use and Health (formerly called the “National Household Survey”) starting in 2006

15